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# *"Resolution of recurrent tonsillitis in a non- smoker who became a vaper. A case study and new hypothesis"*

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## Abstract

**Background:** Evidence concerning the impact of vaping on respiratory infections remains contradictory. Cell and animal studies suggested that vaping may increase vulnerability to respiratory infections, but human data do not confirm the concern.

**Case Presentation:** We present a case of a never-smoker who became a vaper and after a few months of e-cigarette use experienced a complete resolution of chronic tonsillitis and a marked improvement in tonsilloliths.

**Conclusions:** As this is a never-smoker, the improvements cannot be attributed to smoking cessation. One possible explanation is that the improvement was due to antimicrobial properties of propylene glycol. The hypothesis could be tested by a trial of zero-nicotine e-cigarettes in patients with recurrent bacterial throat infection.

**Background:**

Unlike conventional cigarettes, e-cigarettes (EC) deliver no combustion chemicals and are therefore considered to be much safer (1). Vaping may however still pose a degree of risk due to other chemicals present in e-liquid and due to their thermal degradation.

One of the effects of vaping where there is contradictory evidence concerns the impact on respiratory infections. Cell and animal studies (2,3) suggested that vaping may increase vulnerability to respiratory infections, but human data do not confirm the concern and the pre-clinical findings allow alternative interpretations (4). In the animal study, the susceptibility to infections could be due to chronic and massive nicotine overdosing and stress, while in the cell study, the damage to epithelial cells harvested from 8 to 10 year old donors resulted from incubation in e-liquid (not e-cigarette aerosol). Regarding human data on vaping and respiratory health, some transient symptoms such as throat irritation and coughing have been reported but no significant adverse respiratory effects were associated with EC use for up to 1.5 years (5). In a large youth cohort, there was no link between vaping and respiratory symptoms when adjusting for smoking status but past EC use was linked to an increase in some symptoms and a decrease in wheezing (6). Asthmatic smokers who switched to vaping recorded significant improvements in asthma outcomes (7). Progressive reduction in yearly respiratory exacerbations has been documented throughout a 2-year reporting period in COPD patients who quit or substantially reduced their tobacco consumption by switching to EC use (8).An online survey of 941 vapers that asked them about any changes in their respiratory infections found that 5% reported worsening, 29% reported no change, and 66% reported an improvement (9). A selection bias may have played a role in this surprising result,

but there exists a putative explanation for a genuine beneficial effect. One of the key ingredients of e-liquid is propylene glycol that is known to have anti-microbial effects (10).

We report here on an association between vaping and chronic throat infection in a non-smoker who became a vaper.

**Case presentation:**

During an on-line survey of vapers (9), an unusual report was noticed from a non-smoker who became a daily vaper. The person (LM) agreed to be contacted and we followed her up over several weeks and elicited the following details.

LM is a 26-year old computer scientist. She is overall in good health, but suffered from ear infections in childhood and had two episodes of severe otitis media and an eardrum rapture in adulthood.

Her main health problem are frequent episodes of tonsillitis that started when she was about seven years old. She also suffers from recurrent tonsilloliths, from about the age of 17.

She would typically have sore throat upon waking, followed by some improvement after eating, with fluctuations throughout the day. Her tonsils would be red and swollen, often with white spots, and her voice would be hoarse. This would be accompanied by pain or discomfort when swallowing. She would cough up dark yellow/brown phlegm and have some discharge from her nose throughout the day. The problem would be present for about seven days per month. In childhood, she was repeatedly prescribed antibiotics. She saw two ENT specialists but was advised against tonsillectomy. Her current GP recommended that she waits for the infections

to clear by themselves and they usually do, but then return a few weeks later. Over the past few years, she came to accept the there is no medical treatment for her condition and stopped seeking further help.

LM never smoked. Her partner stopped smoking and switched to vaping about eight months ago and now uses e-liquid with 0mg to 3mg/ml of nicotine. LM first tried her partner's e-cigarette out of curiosity in April 2016. As her partner moved on to a newer EC device, she „inherited" his old device and started to use it more regularly. She enjoyed the activity of vaping and progressed to using some 8-20 ml of e-liquid per day. She uses e-liquid with 0 – 3mg/ml nicotine with varied flavours. She can go without vaping for extended period of time with no discomfort. She thinks that vaping met her need to do something with her hands (she tends to fidget and used to bite her nails prior to taking up vaping) and has reduced her snacking on sweets and chocolate throughout the day. She likes sweet and fruity vaping flavours and enjoys vaping together with her partner.

After about three months of vaping, LM noticed that her throat was not sore in the mornings any more. She also did not have to clear her throat and stopped coughing up phlegm. Her tonsilloliths were intermittent and so she waited to see if they improve as well. She had now been vaping for eight months and her tonsillitis has not recurred, and her tonsiloliths have markedly improved. In addition to this, since starting vaping LM has not suffered a single respiratory infection or common cold. LM is not sure what caused these improvements but she is enjoying them greatly.

**Discussion and conclusions:**

The present case study is of particular interest because LM is a non-smoker. Smoking increases susceptibility to respiratory infections (11) and so a similar

recovery in a smoker who switched to vaping could be ascribed to smoking cessation.

No bacteriological examination was performed and case studies of course can not exclude coincidences and spontaneous improvements, but the reported case does generate a tentative hypothesis and research question.

There is a possibility is that propylene glycol in EC aerosol affected a microbial strain that was causing LM problems. Nicotine at low concentration is also known to have anti-inflamatory effects and this may have played a role as well (13), although LM uses primarily nicotine free EC. A classical experiment testing antimicrobial properties of propylene glycol (1mg of propylene glycol vapour in two to four million cc.) reported achieving a complete sterilisation of air sprayed with streptococci, pneumococci, staphylococci, H. influenzae, other microorganisms, including influenza virus (12). Whether EC aerosol has the same effect remains unknown. LM's case is consistent with recurrent exacerbation of chronic tonsillitis. As viruses more frequently cause such exacerbations than bacteria, virucidal effects of propylene glycol may have been involved. A trial of vaping zero-nicotine e-cigarettes in patients with recurrent throat infections could clarify whether this anecdotal observation was a coincidence, a rare idiosyncratic reaction, or an effect that could benefit others.

**Competing Interests:**

Neither of the authors declare any conflict of interest.

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**Authors' contributions:**

JAM collected data. JAM and PH co-wrote the manuscript.

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References

1. Tobacco Advisory Group of the Royal College of Physicians. Nicotine without smoke—tobacco harm reduction. Royal College of Physicians, 2016. Available at: https://www.rcplondon.ac.uk/projects/outputs/nicotine-without-smoke-toba... (last accessed on May 04, 2016).

2. Wu Q, Jiang DJ, Minor M and Chu HW (2104) Electronic cigarette liquid increases inflammation and virus infection in primary human airway epithelial cells. PLoS One e108342.

3. Sussan TE, Gajghate S, Thimmulappa RK, Ma J, Kim J-H, Sudini K, et al. (2015) Exposure to Electronic Cigarettes Impairs Pulmonary Anti-Bacterial and Anti-Viral Defenses in a Mouse Model. PLoS ONE 10(2): e0116861.

4. Campagna D, Amaradio M, Sands M, Polosa R (2016) Respiratory infections and pneumonia: potential benefits of switching from smoking to vaping. Pneumonia 8:4 DOI: 10.1186/s41479-016-0001-2

5. Hartmann-Boyce J, McRobbie H, Bullen C, Begh R, Stead LF, Hajek P. (2016) . Electronic cigarettes for smoking cessation and reduction.The Cochrane database of systematic reviews vol. 12, 10.1002/14651858.CD010216.pub2

6. McConnell R, Barrington-Trimis JL, Wang K, Urman R, Hong H, Unger J, Samet J, Leventhal A, Berhane K. (2016). Electronic-cigarette Use and Respiratory Symptoms in Adolescents. *Am J Respir Crit Care Med*. 2016 Nov 2. [Epub ahead of print]

7. Polosa, R.; Morjaria, J.; Caponnetto, P.; Caruso, M.; Strano, S.; Battaglia, E.; Russo, C. Effect of Smoking Abstinence and Reduction in Asthmatic Smokers

Switching to Electronic Cigarettes: Evidence for Harm Reversal. Int. J. Environ. Res. Public Health 2014, 11, 4965-4977.

8. Polosa, R, Morjaria JB, Caponnetto P, Prosperini U, Russo C, Pennisi A, Bruno CM. 2016. Evidence for harm reduction in COPD smokers who switch to electronic cigarettes. *Respir Res* 17, 166.

9. Miler JA, Mayer B, Hajek P. Changes in the Frequency of Airway Infections in Smokers Who Switched To Vaping: Results of an Online Survey J Addict Res Ther 2016, 7:4

10. Nalawade TM, Bhat K, Sogi SH. Bactericidal activity of propylene glycol, glycerine, polyethylene glycol 400, and polyethylene glycol 1000 against selected microorganisms. J Int Soc Prevent Communit Dent 2015;5:114-9

11. Feldman C, Anderson R (2013). Cigarette smoking and mechanisms of susceptibility to infections of the respiratory tract and other organ systems. J Infect. 67(3):169-84

12. Robertson OH, Bigg E, Puck TT, Miller BF. The bactericidal action of propylene glycol vapor on microorganisms suspended in air. I. J Exp Med. 1942 Jun 1;75(6):593–610.

13. Comer, D. M., Elborn, J. S., & Ennis, M. (2014). Inflammatory and cytotoxic effects of acrolein, nicotine, acetylaldehyde and cigarette smoke extract on human nasal epithelial cells. *BMC Pulmonary Medicine*, 14, 32. http://doi.org/10.1186/1471-2466-14-32